



European Commission Directorate-General for Climate Action,  
Avenue de Beaulieu 24,  
1160 Auderghem,  
Belgium

April 20, 2020, Brussels

**RE: Briefing Paper: HFCs and HFC alternatives in split air conditioning systems**

Following the request for input on the draft technical papers shared via email upon the cancellation of the March 25 F-Gas Consultation Forum, shecco would like to submit feedback that reflects some of the major developments and concerns of the natural refrigerant industry in relation to HFCs and HFC alternatives in split air-conditioning systems.

The March 2020 draft paper compiled by Öko-Recherche and CITEPA aims to assess whether “cost-effective, technically feasible, energy-efficient and reliable alternatives exist, which make the replacement of fluorinated greenhouse gases (F-gases) possible in new small single split air-conditioning systems.” According to our extensive market research, natural refrigerant R290 (propane) is the *only* alternative that ticks every single one of these boxes and can be recommended as a world-wide replacement.

Here follows shecco’s general comments with regards to the briefing paper. Our response is two-fold, covering the commercial availability and advantages of selecting a natural refrigerant such as R290, while also highlighting the downfalls pertaining to the fluorinated alternatives suggested in the briefing paper.

**General: 750 GWP to 150**

The ban on HFCs with a GWP higher than 750 for small split air conditioning is not sufficient to reach the HFC phase-down and does not create incentives for the industry to go towards the long-term HFC-free solutions. The market for R290-based portable air conditioning is already moving as a result of the ban. The split air conditioning subsector is, however, largely adopting R32 (as confirmed by the briefing paper as well).

A number of industry representatives that shecco interviewed stated that R32 is an intermediary solution, but there is currently lack of legislative push or other incentives to adopt a long-term HFC-free technology.

shecco believes that revising the GWP limit for small split AC to 150 (instead of current 750) would create the necessary legislative push to accelerate the transition of this sector to energy-efficient and future-proof solutions. This would help reach the objectives of the HFC phase-down and avoid locking in medium-GWP HFCs.

## **20-year vs 100-year GWP: R32 is unsustainable**

shecco suggests measuring GWP over 20 years instead of 100 to get a more accurate picture of the impact of the refrigerant used on the environment. The standard 100-year calculation can potentially skew perceptions in terms of how harmful certain F-gases really are. The 20-year metric better reflects the true potency of HFCs during their actual time in the atmosphere, which averages out to 21.7 years, according to an Öko-Recherche paper<sup>1</sup> presented at the 2012 Gustav Lorentzen Conference.

The GWP-100 metric makes some HFCs “deceptively attractive,” said the report. For example, R32, which has a GWP of 675 over 100 years, has a GWP of 2,330 over 20 years. This shows that in fact, contrary to common belief, R32 is *not* a low-GWP solution at all.

## **HFOs, blends and the environment**

shecco also cautions against the use of synthetic HFO refrigerants or HFO-blends as their impact on the environment is still unproven.

Although HFOs boast low GWPs, a study from the Norwegian Environmental Protection Agency<sup>2</sup> warns that HFOs, such as R1234yf used in the automotive industry, breaks down into trifluoroacetic acid (TFA) within two weeks, which, in large quantities, could potentially cause acid rain. The study concluded that TFA is expected to become concentrated in terminal sinks due to it being highly persistent. The risk, therefore, increases as the emissions from HFOs to the environment increase.

Another factor to consider is that many of the new HFO blends are patented, fixing the price quite high and limiting commercial availability.

## **Cost-effectiveness comparison**

To ensure sustainable cooling for all, it is vital that the alternative considered for domestic air-conditioning solutions be cost-effective. We suggest a cost column be added to the table on page 4-5 when comparing the alternatives. This will highlight that the natural refrigerants

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<sup>1</sup> Kanter, D., Mate, J. 2012. The Benefits of Basing Short Term Climate Protection Policies on the 20 Year GWP of HFCs. Frankfurt, Öko-Recherche GmbH.

<sup>2</sup> Ashford, P., Fleet, D., Hanlon, J., La Vedrine, M., Osborne, K. 2017. Norwegian Environment Agency (NEA). Study on environmental and health effects of HFO refrigerants. Norway, NEA. <https://www.miljodirektoratet.no/globalassets/publikasjoner/M917/M917.pdf> (20.04.2020)

such as R290 are less expensive than any of the other suggested alternatives, especially HFOs and blends.

## **Natural refrigerants in HVAC**

In recent years, the HVAC&R industry has seen an increased focus on becoming more sustainable. As part of this trend, the commercial refrigeration industry in particular has moved towards more environmentally friendly natural refrigerants, spending a great deal on R&D to improve energy efficiencies and make technology commercially available throughout the world.

Unfortunately, the air-conditioning and heating market has been lagging behind compared to the refrigeration sector, despite massive opportunity to develop towards more climate friendly alternatives. shecco believes that the next 10 years will be key to accelerate this market by educating all stakeholders, making technologies commercially available at a competitive price, and by continuing to develop new solutions.

As such, shecco has partnered with the Danish Technological Institute (DTI) to launch the first-ever conference solely focused on the future of natural refrigerants in HVAC. The global online event will take place on the afternoons (CET) of June 23-24, 2020 with the overarching aim of showcasing available solutions and engaging key stakeholders on the future of natural refrigerants in HVAC.

## **Commercial availability of R290 solutions**

Further to the clear opportunity for the HVAC industry to accelerate towards natural refrigerants, shecco has noticed a great increase in R290 systems in particularly domestic split air-conditioning systems under 7kW (as well as chillers). The technology is developing rapidly and R290 systems are quickly becoming more commercially available, offering a cost-effective alternative to high-GWP systems.

This is largely thanks to ongoing efforts such as the LIFE FRONT project to remove barriers for flammable refrigerants such as R290, as well as enhanced training efforts on a global-scale (such as GIZ's Proklima's natural refrigerant based Cool Training<sup>3</sup> for trainers) – amongst others.

Based on this increased focus in the sector, shecco expects a huge increase in R290 solutions in the coming years, similar to the development of CO<sub>2</sub> solutions within the commercial refrigeration industry over the past decade. We predict that by the time the new F-gas legislation is adopted, R290 technology would've improved even more.

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<sup>3</sup> <https://www.giz.de/en/downloads/giz2016-en-flyer-cool-training.pdf> (20.04.2020)

## **LIFE FRONT – removing flammability barriers for R290**

The LIFE FRONT<sup>4</sup> project aims to remove barriers posed by standards for flammable refrigerants in refrigeration, air conditioning, and heat pump applications. It strives to improve system design to address flammability risk and thereby encourage wider uptake of climate-friendly alternatives to fluorinated gases. The objective of the databases is to show real data on refrigerant leakage to be used as a basis for the standard-making process, replacing the current assumptions that don't necessarily rely on realistic scenarios.

In 2019, LIFE FRONT published “Europe’s largest leakage size database” (the refrigerant leak size database plus the concentration database) for equipment using flammable refrigerants to help improve overall safety measures for systems using such refrigerants. In these two databases, risk parameters are shown realistically and based on the actual frequency of leaks, leak-hole sizes, and mass-flow rates with a fundamental approach to leak-time measurements. Both databases are to be considered as input parameters for safety standards, determining among others the allowable refrigerant charge sizes and system design parameters.

The databases bring an important added value: a statistical approach with information on leak flow rate in relation to the leak cause. This information will enable the participating manufacturers to conduct a thorough risk assessment, to adapt their mitigation measures to the identified leak causes and very importantly: to adapt design, relevant safety devices, and relevant charge size.

## **Cooling Prize sees potential of R290**

In 2018, a global coalition led by the Government of India and Rocky Mountain Institute (RMI) announced the eight finalists of the Global Cooling Prize, an international innovation competition to develop super-efficient, climate-friendly and affordable residential cooling solutions for homes.<sup>5</sup> Two of the finalists (Godrej-Boyce and S&S Design Startup Solution) are incorporating propane (R290) in their systems, while another, Transeara, is likely to transition from R32 to R290 for the prototype, confirmed RMI.

Two others are employing water in their technologies with a third using an organic solid-state material (neopentylglycol). The remaining two systems use HFC-R152a and HFO-R1234ze respectively.

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<sup>4</sup> <http://life-front.eu/leakage-size-database-flammable-refrigerants-online/> (20.04.2020)

<sup>5</sup> <https://accelerate24.news/regions/global-cooling-prize-seeking-climate-friendly-accs-announces-eight-finalists/2019/> (20.04.2020).

## Summary

In summary, shecco recommends lowering the GWP limit for small split air-conditioning system refrigerants from 750 to 150 to reach the objectives of the 2030 HFC phase-down reduction target, as well as to avoid locking in unsustainable medium-GWP HFCs.

These include “interim” solutions such as R32 that are falsely promoted as more environmentally friendly. Although R32 has a GWP of 675 measured over 100 years, it has a GWP of 2,330 measured over 20 years. shecco believes that the 20-year metric should be adopted to more accurately depict the true effects of refrigerants during the time they are active in the atmosphere.

HFO and HFO-blend solutions should also not be considered feasible alternatives as the full environmental impact has yet to be confirmed. There is growing evidence that large quantities of HFOs could have catastrophic long-term effects such as potentially causing acid rain.

As such, shecco believes the only viable alternative for split air-conditioning systems smaller than 7kW is natural refrigerant solutions such as R290 (propane). This is a cost-effective, future-proof, environmentally friendly technology boasting ongoing innovation and increased commercial availability (as can be seen by the Cooling Prize for instance). The flammability risk addressed by projects such as LIFE FRONT and widespread global training initiatives, removing the biggest perceived barrier.

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### About shecco

shecco is a company specialized in market development for natural refrigerant-based technologies for heating and cooling applications. Over the last 17 years, shecco has developed a unique expertise on natural refrigerant technologies, built an extensive knowledge (sheccoBase) and a large network of experts (20,000+) active in this field. shecco works with about 200 industry partners in the heating, air-conditioning and refrigeration sector with the aim of accelerating the introduction of HFC-free technologies, removing the market, technology, policy and knowledge barriers.

Headquartered in Brussels and with offices in Tokyo and New York, shecco has developed a large network of contacts worldwide through attendance in local events and more importantly shecco's global series of events, ATMOSphere which has become a key forum to discuss and drive the business case for natural refrigerants and clean cooling.